Controls—LonMark DDC VAV Controller

Introduction

This LonMark™ certified controller uses the Space Comfort Controller (SCC) profile to exchange information over a LonTalk™ network. Networks with LonMark certified controllers provide the latest open protocol technology. Being LonMark certified guarantees that owners and end-users have the capability of adding Trane products to other "open" systems and relieves owners of the pressure and expense of being locked into a single DDC supplier. The Trane VV550 VAV controller with VariTrane VAV units can be applied to more than just Trane systems. When a customer buys a Trane VAV unit with Trane DDC controller, they take advantage of:

- Factory-commissioned quality
- Knowing they have selected the most reliable VAV controllers in the industry
- Trane as a single source to solve any VAV equipment, or system-related issues
- The most educated and thorough factory service technicians in the controls industry
- Over 150 local parts centers throughout North America that can provide what you need, when you need it.

Don't let your existing controls supplier lock you out of the most recognized name in VAV system control in the industry. Specify Trane open-protocol systems.

What are the new features of this controller? Read on to find out more.

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Don't let your existing controls supplier lock you out of the most recognized name in VAV system control in the industry. Specify Trane open-protocol systems.

VV550—Trane DDC LonMark Controller

Single-Duct Terminal Unit (VCCF, VCWF, and VCEF)

Unit Heat	Control	Description	Page #
Cooling Only (VCCF model)	DD11	Space Temp Control without Reheat	C 35
	DD12	Space Temp Control with Remote Normally-Closed On/Off Hot Water Valve (Normally-Open Outputs)	C 35
	DD13	Space Temp Control with Remote Proportional Hot Water Valve with Optional Spare On/Off Output	C 35
	DD14	Space Temp Control with Remote Staged Electric Heat	C 35
	DD15	Space Temp Control with Remote Pulse-Width Modulation Electric Heat	C 35
	DD17	Space Temp Control with Remote Normally-Open On/Off Hot Water Valve (Normally-Closed Output)	C 35
Hot Water (VCWF model)	DD12	Space Temp Control with Normally-Closed On/Off Hot Water Valve (Normally-Open Outputs)	C 35
	DD13	Space Temp Control with Proportional Hot Water Valve with Optional Spare On/Off Output	C 35
	DD17	Space Temp Control with Normally-Open On/Off Hot Water Valve (Normally-Closed Output)	C 35
Electric (VCEF model)	DD14	Space Temp Control with Staged Electric Heat	C 35
	DD15	Space Temp Control with Pulse-Width Modulation Electric Heat	C 35

Dual-Duct Terminal Unit (VDDF)

Unit Heat	Control	Description	Page #
(VDDF model)	DD11	Space Temp Control (No Remote Heat) and Heating Control	C 36
	DD18	Space Temp Control (No Remote Heat) and Heating—Constant-Volume Control	C 36

Fan-Powered Terminal Units *with PSC Motor* (VPCF, VPWF, VPEF, VSCF, VSWF, and VSEF)
Low-Height Fan-Powered Terminal Units *with PSC Motor* (LPCF, LPWF, LPEF, LSCF, LSWF, and LSEF)

Unit Heat	Control	Description	Page #
Cooling Only (VPCF, VSCF, LPCF, LSCF models)	DD11	Space Temp Control without Reheat	C 37
	DD12	Space Temp Control with Remote Normally-Closed On/Off Hot Water Valve with Normally-Open Outputs	C 37
	DD13	Space Temp Control with Remote Proportional Hot Water Valve	C 37
	DD14	Space Temp Control with Remote Staged On/Off Electric Heat	C 37
	DD15	Space Temp Control with Remote Pulse-Width Modulation Electric Heat	C 37
	DD17	Space Temp Control with Remote Normally-Open On/Off Hot Water Valve with Normally-Closed Outputs	C 37
Hot Water (VPWF, VSWF LPWF, LSWF)	DD12	Space Temp Control with Normally-Closed On/Off Hot Water Valve with Normally-Open Outputs	C 37
	DD13	Space Temp Control with Proportional Hot Water Valve	C 37
	DD17	Space Temp Control with Normally-Open On/Off Hot Water Valve with Normally-Closed Outputs	C 37
Electric (VPEF, VSEF LPEF, LSEF)	DD14	Space Temp Control with Staged On/Off Electric Heat	C 37
	DD15	Space Temp Control with Pulse-Width Modulation Electric Heat	C 37

Fan-Powered Terminal Units *with ECM* (VPCF, VPWF, VPEF, VSCF, VSWF, and VSEF)

Unit Heat	Control	Description	Page #
Cooling Only (VPCF, VSCF models)	DD11	Space Temp Control without Reheat	C 38
	DD12	Space Temp Control with Remote Normally-Closed On/Off Hot Water Valve with Normally-Open Outputs	C 38
	DD13	Space Temp Control with Remote Proportional Hot Water Valve	C 38
	DD14	Space Temp Control with Remote Staged On/Off Electric Heat	C 38
	DD15	Space Temp Control with Remote Pulse-Width Modulation Electric Heat	C 38
	DD17	Space Temp Control with Remote Normally-Open On/Off Hot Water Valve with Normally-Closed Outputs	C 38
Hot Water (VPWF, VSWF models)	DD12	Space Temp Control with Normally-Closed On/Off Hot Water Valve with Normally-Open Outputs	C 38
	DD13	Space Temp Control with Proportional Hot Water Valve	C 38
	DD17	Space Temp Control with Normally-Open On/Off Hot Water Valve with Normally-Closed Outputs	C 38
Electric (VPEF, VSEF models)	DD14	Space Temp Control with Staged On/Off Electric Heat	C 38
	DD15	Space Temp Control with Pulse-Width Modulation Electric Heat	C 38
			C 38

Controls—LonMark DDC VAV Controller

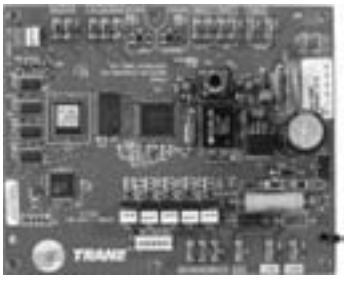
Features & Benefits

General Features and Benefits

Assured Accuracy

- Proportional-plus-integral control loop algorithm for determining required airflow needed to control room temperature. Airflow is limited by active minimum and maximum airflow setpoints.
- Pressure-independent (PI) operation that automatically adjusts valve position to maintain required airflow. In certain low-flow situations or in cases where the flow measurement has failed, the DDC controller will operate in a pressure-dependent (PD) mode of operation.
- When combined with the patented Trane Flow ring and pressure transducer, flow is repeatable to +/- 5% accuracy across the Pressure Independent (PI) flow range. (See Valve/Controller Airflow Guidelines section).
- Improved 2-Point Air Balancing is available – Assures optimized flow-sensing accuracy across the operating range. This provides a more accurate airflow balancing method when compared to typical single-point flow correction air balancing.
- Analog input resolution of +/- 1/8°F within the comfort range maximizes zone temperature control yielding excellent comfort control.

LonMark VV550 DDC VAV Controller



Reliable Operation

- Built for life – Trane products are designed to stand the test of time, with a proven design life that exceeds 20 years.
- Fully factory tested – fully screened and configured at the factory. All features are tested including fan and reheat stage energization, air valve modulation, and controller inputs and outputs.

Safe Operation

- All components, including the controller, pressure transducer, transformer, etc. are mounted in a NEMA 1 sheet metal enclosure and are tested as an assembly to UL1995 standards. The result is a rugged and safe VAV, controller, and thus, overall unit.
- When in PI-mode, EH is disabled when the sensed flow is below the minimum required.
- HW coil VAV units in ventilation flow control (VFC) have a Freeze protection algorithm to protect the water coil and the internal space from water damage. This is accomplished by driving the water valve to maximum position on alarm conditions.

System-Level Optimization

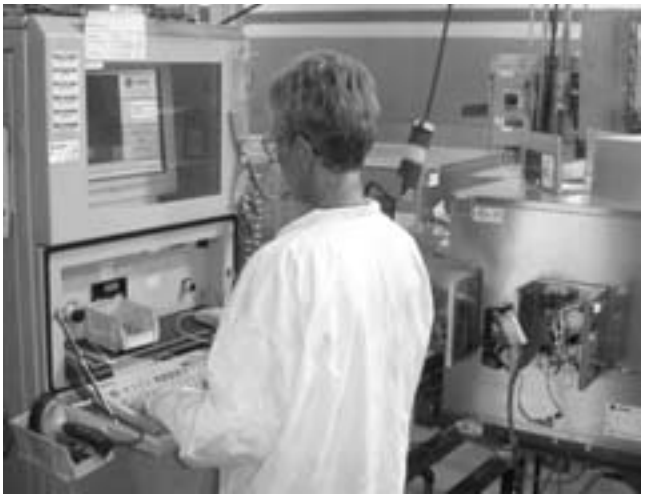
Trane controllers are designed to integrate into Trane Tracer Summit Systems and leverage clear and clean unit-controller related data for system level control decisions. Integrating a Trane VV550 controller into a Tracer Summit Control System provides the next step in building system control.

Specifically, system-level decisions on how to operate all components can be made. Energy efficient optimization strategies like Static Pressure Optimization, Ventilation Reset, and CO_2 Demand-controlled Ventilation can be employed with the simple press of a button. The end-result is the most efficient and reliable building control system available.

Simplified Installation

Factory Commissioned Quality – All Trane DDC VAV controllers are factory-commissioned. This means that the DDC boards are powered and run-tested with your specific sequence parameters. They are connected to a communication link to make sure that information and diagnostic data function properly. Before any VariTrane VAV unit ships they must pass a rigorous quality control procedure. You can be assured that a Trane VAV unit with Trane DDC VAV controls will work right out of the crate.

Factory-commissioning of unit



Zone sensor air balance – When applied to a Trane zone sensor with thumbwheel and on/cancel buttons, a balancing contractor can drive the primary air valve to maximum or minimum airflow from the sensor to determine the point of calibration to be used (maximum will result in optimum performance). The flow reading can then be calibrated from the sensor, without the use of additional service tools. (Non-LCD versions)

DDC Sensor with Thumbwheel & NSB

Tenant-Finish Heat Mode – In some office projects, the building is being constructed as tenants are being identified. Tenant-finish heat mode is designed for applications when a given floor has not been occupied. The main AHU system is used for heat and because the internal furnishings are not complete, the sensors have not been installed. In this case, the primary valve drives open using the heat of the main AHU to keep plumbing lines from freezing. When available, the operation of the VAV unit fan (series or parallel) remains unaffected.

Controller Flexibility

- 24 VAC binary input that can be configured as a generic input or as occupancy input. When the DDC controller is operating with Tracer Summit, the status of the input is provided to Tracer Summit for its action. In stand-alone operation and when configured for an occupancy input, the input will control occupancy status of the DDC controller.
- Auxiliary temperature analog input configured for an auxiliary temperature sensor. The value of the input is used as status-only by Tracer Summit if Tracer Summit is providing a supply air temperature to the DDC controller. Otherwise, the input will be used for determining heating/cooling control action of the VAV unit. When the auxiliary temperature sensor is located in the discharge of the unit, and attached to a Trane Tracer Summit BAS, additional test sequencing and reporting is available to maximize VAV system capabilities and simplify system commissioning.
- Dual-duct support with two DDC controllers. One DDC controller controls the cooling air valve and the other controller controls the heating air valve. With constant-volume sequences, the discharge air volume is held constant by controlling discharge air volume with the heating Controller.
- LonMark certified performance ensures that a Trane VAV with controller will provide state-of-the-art, consistent open communication protocol for integration with the industry's latest (Non-Trane) building automation control systems, including Johnson Control, Andover, Siemans, Honeywell, etc.
- CO2 demand controlled ventilation enables a HVAC system to adjust ventilation flow based on critical zone, average CO_2 of specified zones, etc. Trane demand controlled ventilation strategies are pre-defined for simplifed application and can be easily customized to meet the needs of a specific system.

Trane DDC VAV Controller Logic

Control Logic
Direct Digital Control (DDC) controllers are today's industry standard. DDC controllers share system-level data to optimize system performance (including changing ventilation requirements, system static pressures, supply air temperatures, etc.). Variables available via a simple twisted-shielded wire pair include occupied/unoccupied status, minimum and maximum airflow setpoints, zone temperature and temperature setpoints, air valve position, airflow cfm, fan status (on or off), fan operation mode (parallel or series), reheat status (on or off), VAV unit type, air valve size, temperature correction offsets, flow correction values, ventilation fraction, etc.

With the advent of LonMark open protocol, the most reliable VAV controller is now available for ANY system. Gone are the days of being locked into a single supplier. Trane DDC controllers provide Trane-designed solid-state electronics intended specifically for VAV applications including:

1. Space Temperature Control
2. Ventilation Flow Control (100% outside air applications)
3. Flow Tracking Space Pressurization Control (New feature)

Space Temperature Control

Space temperature control applications are where Trane emerged as an industry leader in quality and reliability. This did not occur overnight and has continued to improve as our controller and control logic has improved over time. STC employs controller logic designed to modulate the supply airstream and associated reheat (either local or remote) to exactly match the load requirements of the space.

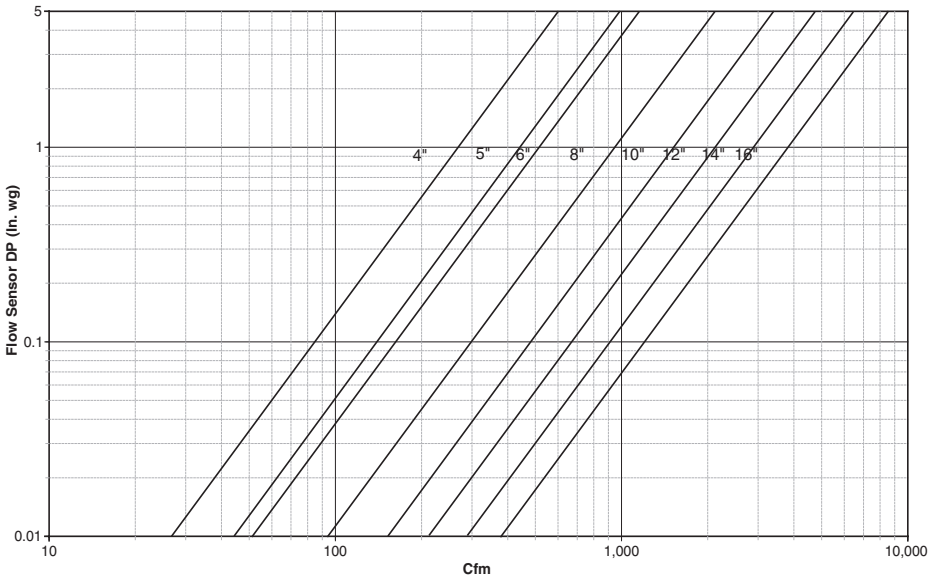
Additionally, minimum and maximum airflow and specific controller sequence requirements are pre-programmed to ensure that appropriate ventilation standards are consistently maintained. When connected to a Trane Tracer Summit control system, trend logging, remote alarming, etc. are available to fully utilize the power and capabilities of your systems.

General Operation-Cooling
In cooling control action, the DDC controller matches primary airflow to cooling load. The DDC controller will automatically change over to heating control action if the supply air temperature is above a configured/editable setpoint. When the supply air temperature is less than 10 degrees below this setpoint, the controller will automatically switch to cooling control action. The DDC controller first chooses the Tracer Summit-provided supply air temperature value to use for auto changeover. If this is not available, it uses the temperature provided by the optional auxiliary temperature sensor (must be installed for inlet temperature monitoring). If this is also not available, it uses the heating/cooling mode assigned by Tracer Summit or the DDC controller's service tool.

General Operation-Reheat
In heating control action, the DDC controller matches primary airflow to heating load. The DDC controller will automatically change over to heating control action if the supply air temperature is above a configured/editable setpoint. When the supply air temperature is less than 10 degrees below this setpoint, the controller will automatically switch to cooling control action. The DDC controller first chooses the Tracer Summit-provided supply air temperature value to use for auto changeover. If this is not available, it uses the temperature provided by the optional auxiliary temperature sensor (must be installed for inlet temperature monitoring). If this is also not available, it uses the heating/cooling mode assigned by Tracer Summit or the DDC controller's service tool.

When heat is added to the primary air, the air is considered reheated. Reheat can be either ***local*** (integral to the VAV unit in the form of an electric coil or hot water coil) or ***remote*** (typically existing wall fin radiation, convector, etc.) or any combination of local and remote. The operating characteristics of the four basic types of VariTrane DDC terminal reheat are discussed.

Flow Sensor Signal vs. Airflow Delivery



Note: Flow sensor DP (in. wg) is measured at the flow ring to aid in system balancing and commissioning. See "Valve/Controller Airflow Guidelines" in each section for unit performance.

Single-Duct: On/Off Hot Water Reheat – Three stages of on/off hot water reheat are available. Two-position water valves complete the HW reheat system and are either fully opened or fully closed. The heating minimum airflow setpoint is enforced during reheat.

Stage 1 energizes when the space temperature is at or below the heating setpoint. When the zone temperature rises above the active heating setpoint by 0.5°F (0.28°C), stage 1 is de-energized. Stage 2 energizes when the space temperature is 1°F (0.56°C) or more below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. Stage 3 energizes when the zone temperature is 2°F (1.11°C) or more below the active heating setpoint, and de-energizes when the space temperature is 1.5°F (0.83°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Single-Duct: Proportional Hot Water Reheat –
Proportional hot water reheat uses 3-wire floating-point-actuator technology. The heating minimum airflow setpoint is enforced during reheat.

The water valve opens as space temperature drops below the heating setpoint. A separate reheat proportional-plus-integral control loop from that controlling airflow into the room is enforced. Water valve position is dependent on the degree that the space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already closed, the water valve fully closes when the zone temperature rises above the active heating setpoint by 0.5 °F (0.28 °C). An additional on/off remote heat output is available and energized when the proportional valve is driven 100% open and de-energized when the proportional valve reaches 50% open. When reheat is de-energized, the cooling minimum airflow setpoint is activated. Again, these reheat devices can be either local or remote.

Single-Duct: On/Off Electric Reheat –
One, two, or three stages of staged electric reheat are available. The heating minimum airflow setpoint is enforced during reheat.

Stage 1 is energized when the space temperature falls below the active heating setpoint and minimum airflow requirements are met. When the zone temperature rises above the active heating setpoint by 0.5°F (0.28°C), stage 1 is de-energized. Stage 2 energizes when the space temperature is 1°F (0.56°C) or more below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. Stage 3 energizes when the zone temperature is 2°F (1.11°C) or more below the active heating setpoint, and de-energizes when the space temperature is 1.5°F (0.83°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

Single-Duct: Pulse-Width Modulation of Electric Heat –
One to three stages of pulse-width modulation of electric heat are available. Energizing for a portion of a three-minute time period modulates the electric heater. This allows exact load matching for energy efficient operation, and optimum zone temperature control. The heating minimum airflow setpoint is enforced during reheat.

The amount of reheat supplied is dependent on both the degree that the space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already off, reheat de-energizes when the zone temperature rises more than 0.5°F (0.28°C) above the heating setpoint.

The Stage 1 "on" time is proportional to the amount of reheat required. For example, when 50% of stage 1 capacity is required, reheat is on for 90 seconds and off for 90 seconds. When 75% of stage 1 capacity is required, reheat is on for 135 seconds and off for 45 seconds. When 100% of stage 1 capacity is required, reheat is on continuously.

Stage 2 uses the same "on" time logic as stage 1 listed above, except stage 1 is always energized. For example, when 75% of unit capacity is required, stage 1 is energized continuously, and stage 2 is on for 90 seconds and off for 90 seconds. When reheat is de-energized, the cooling minimum airflow setpoint is activated. Caution: Care should be taken when sizing electric heaters. Leaving air temperatures (LAT) should not exceed 100°–110°F, with 95°F being the optimal for zone temperature and comfort control. At elevated LATs, room stratification may result in uneven air distribution and zone temperature complaints. To prevent stratification, the warm air temperature should not be more than 20°F (6.7°C) above zone air temperature. (See Diffuser, "D," section for additional application details)

VCEF

**Fan-Powered Terminal Units:
On/Off Hot Water Reheat –**
One or two stages of on/off hot water reheat are available. Two position water valves complete the HW reheat system and are either fully opened or fully closed. The heating minimum airflow setpoint is enforced during reheat.

On parallel fan-powered units, the fan is energized upon a call for heating. The parallel fan is turned off when the space temperature rises above the fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series fan-powered terminal unit fans are continuously energized during occupied mode. When unoccupied, the fan is energized upon a call for heating or cooling and de-energized when unoccupied zone set point is satisfied.

When the zone temperature falls below the active heating setpoint, the UCM modulates the primary airflow to the minimum heating airflow setpoint.

Stage 1 energizes when the space temperature is below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) above the active heating setpoint. Stage 2 energizes when the zone temperature is 1°F (0.56°C) or more below the active heating setpoint, and de-energizes when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

**Fan-Powered Terminal Units:
Proportional Hot Water Reheat –**
Proportional hot water reheat uses 3-wire floating-point-actuator technology. The heating minimum airflow setpoint is enforced during reheat.

On parallel fan-powered units, the fan is energized upon a call for heating. The parallel fan is turned off when the space temperature rises above the fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series fan-powered terminal unit fans are continuously energized during occupied mode. When unoccupied, the fan is energized upon a call for heating or cooling and de-energized when unoccupied zone setpoint is satisfied.

The water valve opens as space temperature drops below the heating setpoint. A separate reheat

VPEF

proportional-plus-integral control loop from that controlling airflow into the room is enforced. The degree to which the hot water valve opens is dependent on both the degree that the space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already closed, the water valve fully closes when the zone temperature rises above the active heating setpoint by 0.5 °F (0.28 °C). When reheat is de-energized, the cooling minimum airflow setpoint is activated.

**Fan-powered Terminal Units:
On/Off Electric Reheat –**
One or two stages of staged electric reheat are available. The heating minimum airflow setpoint is enforced during reheat.

On parallel fan-powered units, the fan is energized upon a call for heating. The parallel fan is turned off when the space temperature rises above the fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series fan-powered terminal unit fans are continuously energized during occupied mode. When unoccupied, the fan is energized upon a call for heating or cooling and de-energized when unoccupied zone set point is satisfied.

Stage 1 energizes when the space temperature is below the active heating setpoint, and is de-energized when the space temperature rises 0.5°F (0.28°C) above the active heating setpoint. Stage 2 energizes when the space temperature is 1.0°F (0.56°C) or more below the active heating setpoint, and is de-energized when the space temperature is 0.5°F (0.28°C) below the active heating setpoint. When reheat is de-energized, the cooling minimum airflow setpoint is activated.

**Fan-powered Terminal Units:
Pulse-Width Modulation of Electric Heat –**
One or two stages of pulse-width modulation of electric heat are available. Energizing for a portion of a three-minute time period modulates

VSEF

the electric heater. This allows exact load matching for energy efficient operation and optimum zone temperature control. The heating minimum airflow setpoint is enforced during reheat.

On parallel fan-powered units, the fan is energized upon a call for heating. The parallel fan is turned off when the space temperature rises above the fan on/off point (active heating setpoint plus fan offset) plus 0.5°F (0.28°C).

Series fan-powered terminal unit fans are continuously energized during occupied mode. When unoccupied, fan is energized upon a call for heating or cooling and de-energized when unoccupied zone set point is satisfied.

The amount of reheat supplied is dependent on both the degree that the space temperature is below the active heating setpoint and the time that the space temperature has been below the active heating setpoint. If not already off, reheat de-energizes when the space temperature rises 0.5°F (0.28°C) above the active heating setpoint. The Stage 1 "on" time is proportional to the amount of reheat required. For example, when 50% of stage 1 capacity is required, reheat is on for 90 seconds and off for 90 seconds. When 75% of stage 1 capacity is required, reheat is on for 135 seconds and off for 45 seconds. When 100% of stage 1 capacity is required, reheat is on continuously.

Stage 2 uses the same "on" time logic as stage 1 listed above, except stage 1 is always energized. For example, when 75% of unit capacity is required, stage 1 is energized continuously, and stage 2 is on for 90 seconds and off for 90 seconds. When reheat is de-energized, the cooling minimum airflow setpoint is activated. When reheat is de-energized, the cooling minimum airflow setpoint it activated.

Ventilation Control

Ventilation control enhances the usability of Trane DDC controllers in more select applications that require measurement of outside air (ventilation). Ventilation control is designed for use with constant volume single-duct VAV units which modulate the primary damper and associated reheat to maintain an average constant discharge air temperature. The reheat is modulated to provide discharge air temperature consistent with AHU supply air temperature (typically 50°–60°F). This is critical to ensure that ASHRAE Standard 62 Ventilation standards are attained, consistently maintained, and monitored. When connected to a Trane Summit control system, trend logging, remote alarming, etc. is available. In fact, the Trane Tracer Control System can provide unmatched "peace of mind" by calling/paging the appropriate person(s) when specific alarms occur.

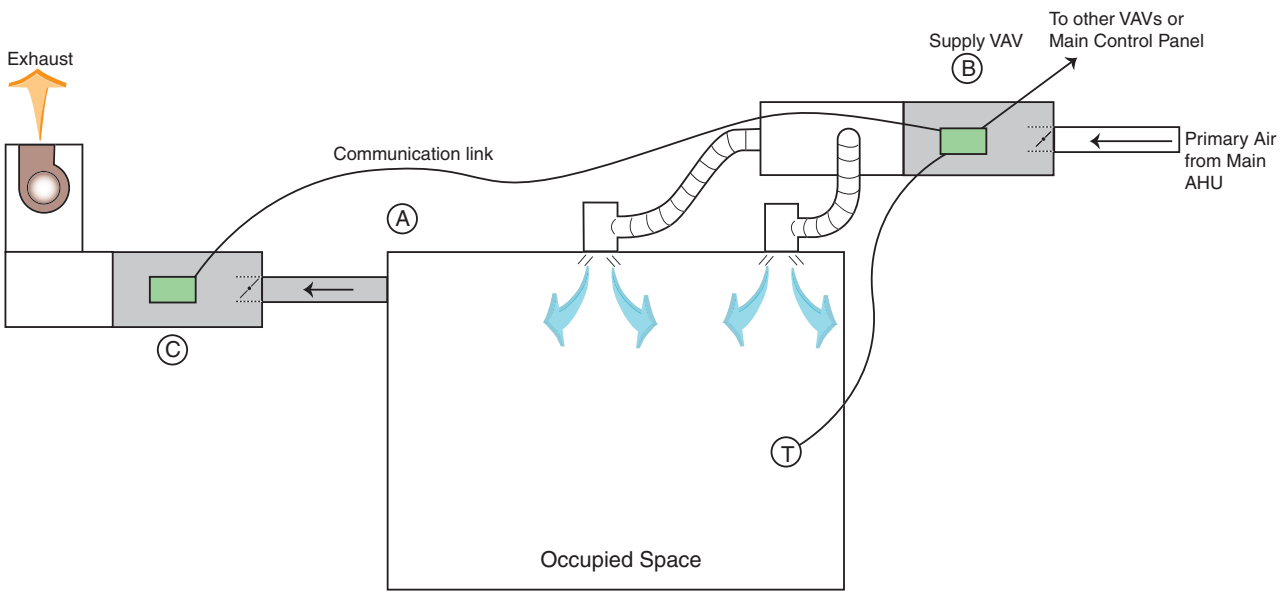
Flow Tracking Control

This enhanced VAV DDC controller feature allows two Trane VV550 controllers to coordinate modulation simultaneously. This allows a specific CFM offset to be maintained. The CFM offset provides pressurization control of an occupied space, while maintaining the comfort and energy savings of a VAV system. A flow tracking system in a given zone consists of a standard Space Comfort Control VAV (see Ⓑ)unit plus a single-duct, cooling-only, exhaust VAV unit (see Ⓒ). As the supply VAV unit modulates the supply airflow through the air valve to maintain space comfort, the exhaust box modulates a similar amount to maintain the required CFM differential. This is a simple, reliable means of pressurization control, which meets the requirements of the majority of zone pressurization control applications. Typical applications include:

- School and University laboratories
- Industrial laboratories
- Hospital operating rooms
- Hospital patient rooms
- Research and Development facilities
- And many more…

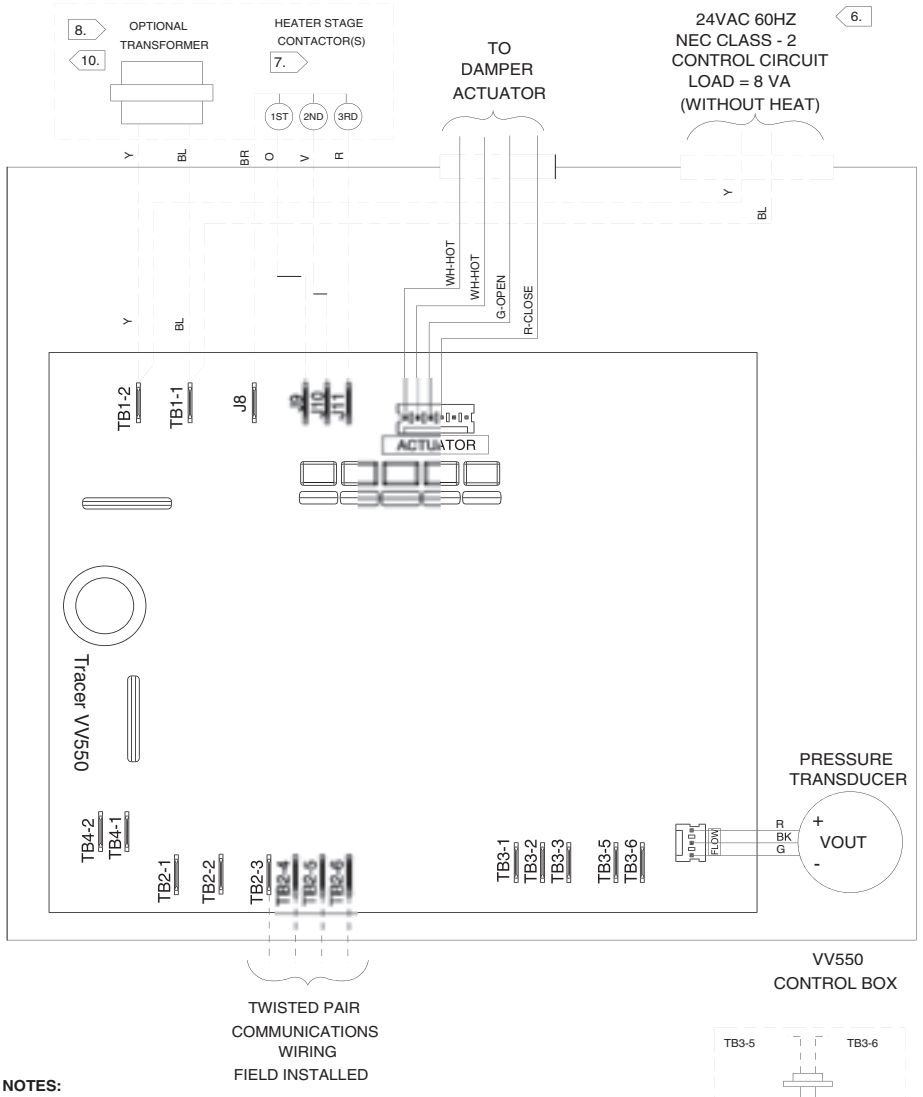
The CFM offset is assured and can be monitored and documented when connected to a Trane Tracer Summit Building Automation System. Flow Tracking Control is designed to meet most pressurization control projects. If an application calls for pressure control other than flow tracking, contact your local Trane Sales Office for technical support.

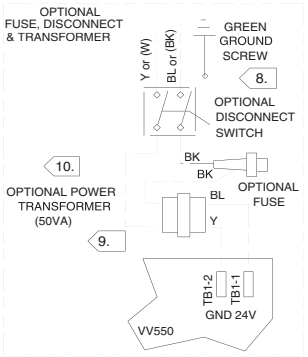
How Does It Operate?

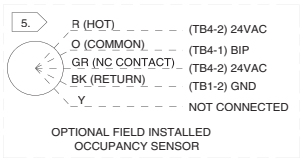


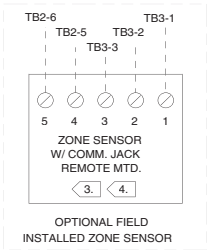
VV550—DDC LonMark Controller for Single-Duct Terminals

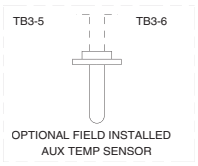
DD11–Space Temp Control Cooling Only
DD12–Space Temp Control w/ N.C. Hot Water Valve
DD13–Space Temp Control w/ Modulating Hot Water Valve
DD14–Space Temp Control w/ Stage Electric Heat
DD15–Space Temp Control w/ Pulse-width Modulation
DD17–Space Temp Control w/ N.O. Hot Water Valve

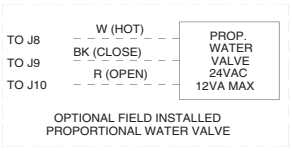


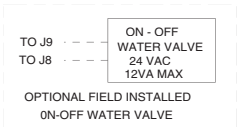












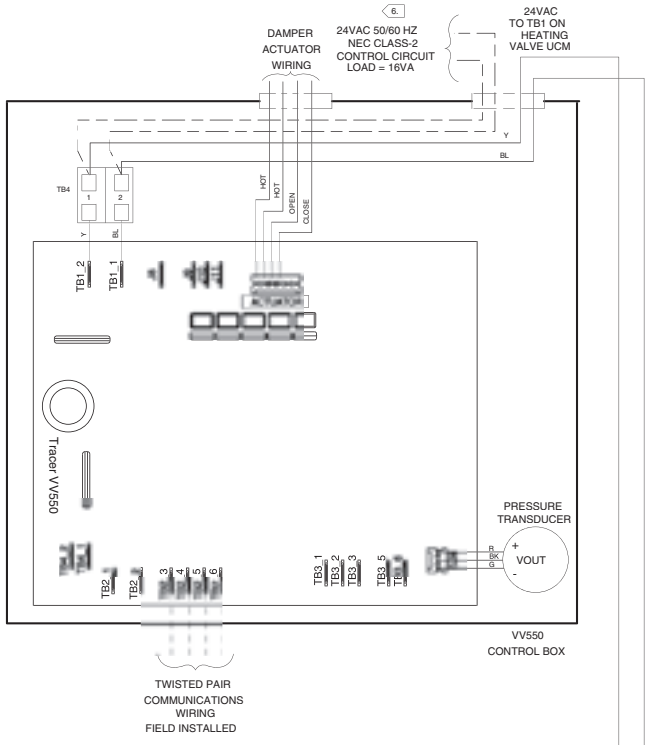
NOTES:

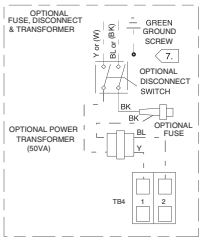
1. Factory Wiring
   Field Wiring
   Optional or Alternate Wiring
2. 1/4" Quick connect required for all field connections.
3. Zone sensor terminals 4 and 5 required twisted pair wiring for communications jack equipped zone sensor option.
4. No additional wiring required for night setback override (ON/CANCEL).
5. The optional binary input connects between TB4–1 (BIP) and 24VAC (HOT) from transformer. The binary input can be reconfigured as an occupancy input via the communications interface.
6. If unit mounted transformer is not provided, polarity from unit to unit must be maintained to prevent permanent damage to control board. If one leg of 24VAC supply is grounded, then ground leg must be connected to TB1–2.
7. Contactors are 24 VAC: 12VA max/coil (Mercury contactors). 10VA max/coil (Magnetic contactors).
8. Optional fuse, disconnect switch and transformer wiring (cooling only or hot water units). Wiring goes through to next component when options are not chosen.
9. Transformer wire colors: 120V–W, 208V–R, 240V–O, 277V–BR, 480V–R/BK, 575V–R, 190V–R, 220V–R, 347V–R.
10. Units with electric heat have optional fuse, disconnect switch and transformer located in heater.
11. Three-stage not available with pulse-width modulation.

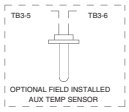
VV550—DDC LonMark Controller for Dual-Duct Terminals

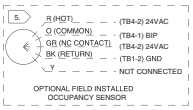
DD11–Space Temp Control (No Remote Heat) and Heating Control
DD18–Space Temp Control (No Remote Heat) and Heating Control—Constant-Volume Control

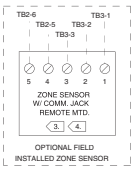
COOLING VALVE



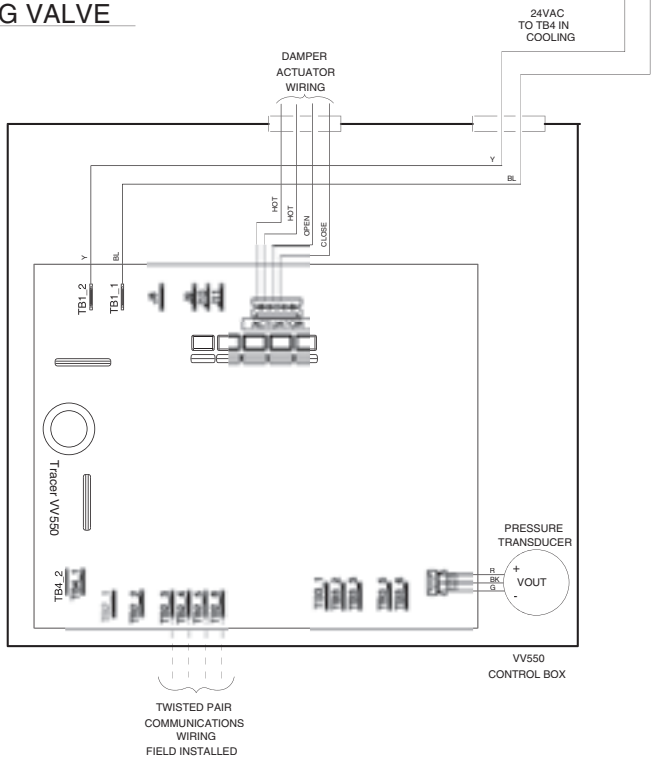








HEATING VALVE

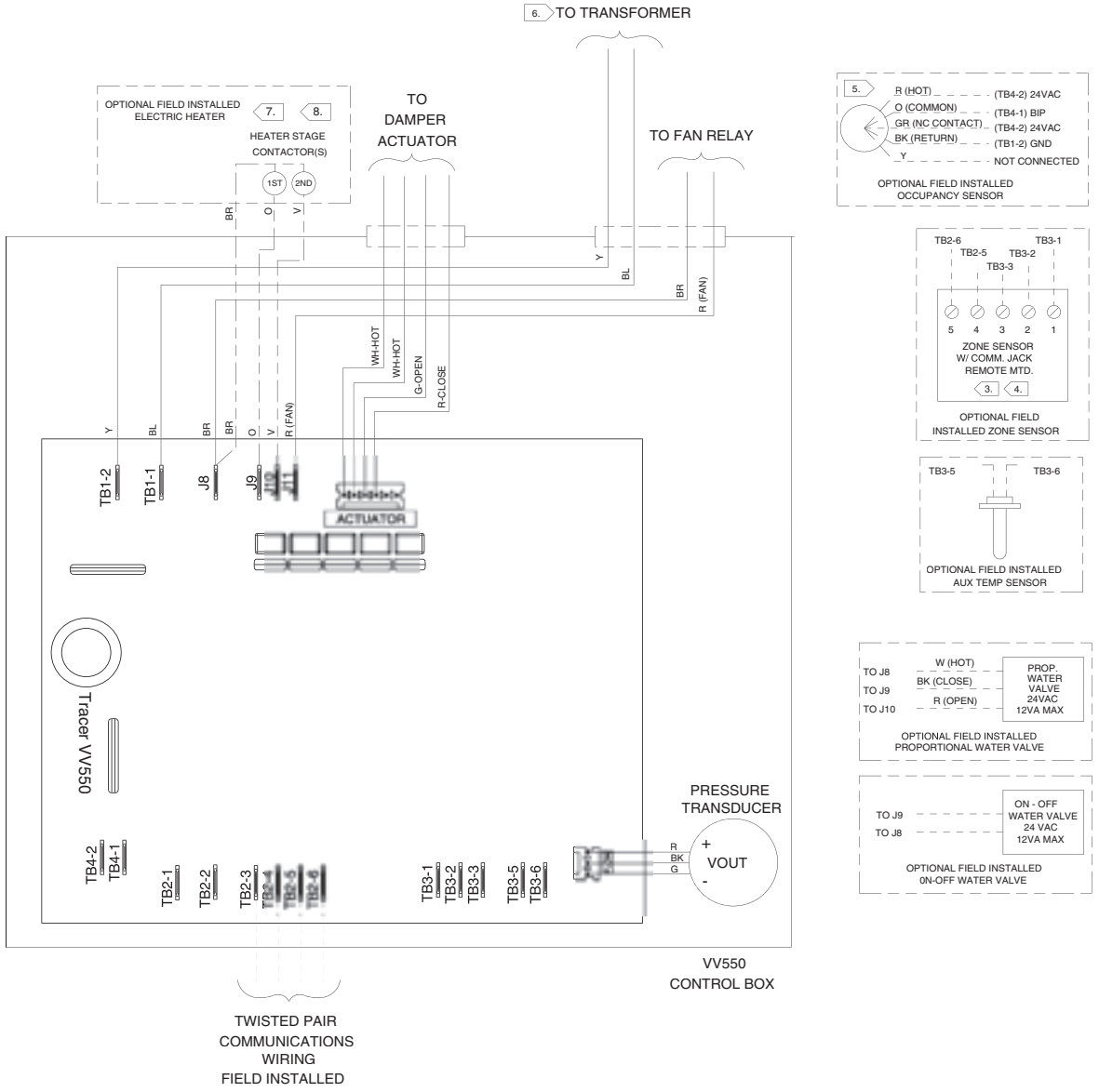


NOTE:

1. Factory Wiring
   Field Wiring
   Optional or Alternate Wiring
2. 1/4" quick connect required for all field connections.
3. Zone sensor terminals 4 and 5 require twisted pair wiring for communications jack equipped zone sensor option.
4. No additional wiring required for night setback override (ON/CANCEL).
5. The optional binary input connects between TB4-1 (BIP) and 24VAC (HOT) from transformer. The binary input can be reconfigured as an occupancy input via the communications interface.
6. If unit mounted transformer is not provided, polarity from unit to unit must be maintained to prevent permanent damage to control board. If one leg of 24VAC supply is grounded, then ground leg must be connected to TB1-2.
7. Optional fuse, disconnect switch and transformer wiring.
8. Cooling controller space temperature and space setpoint network variables should be bound heating controller.

VV550—DDC LonMark Controller for Fan-Powered Terminals

DD11–Space Temp Control Cooling Only
DD12–Space Temp Control w/ N.C. Hot Water Valve
DD13–Space Temp Control w/ Modulating Hot Water Valve
DD14–Space Temp Control w/ Stage Electric Heat
DD15–Space Temp Control w/ Pulse-width Modulation
DD17–Space Temp Control w/ N.O. Hot Water Valve

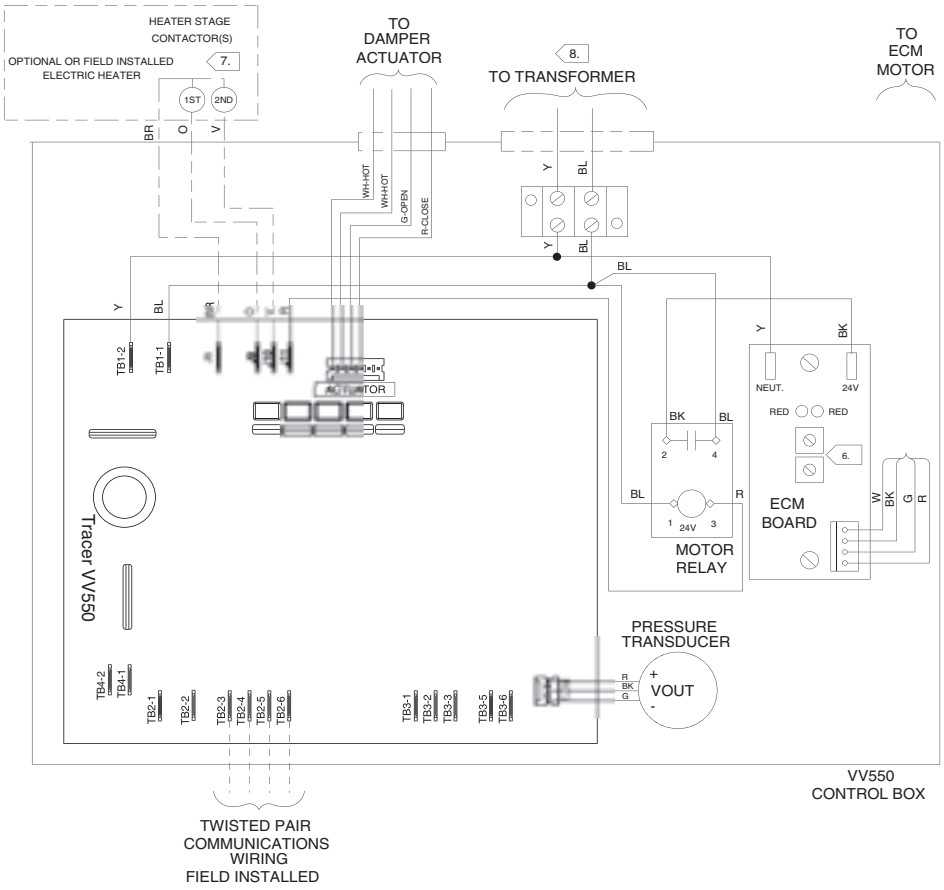


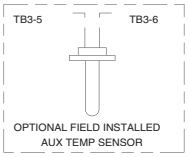
NOTES:

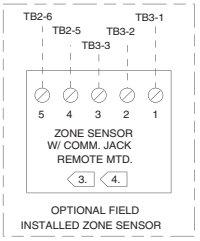
1. Factory Wiring
   Field Wiring
   Optional or Alternate Wiring
2. 1/4" Quick connect required for all field connections.
3. Zone sensor terminals 4 and 5 require twisted pair wiring for communications jack equipped zone sensor option.
4. No additional wiring required for night setback override (ON/CANCEL).
5. The optional binary input connects between TB4–1 (BIP) and 24VAC (HOT from transformer. The binary input can be reconfigured as an occupancy input via the communications interface.
6. Transformer provided in all units.
7. Units with electric heat have optional fuse, disconnect switch located in heater.
8. Contactors are 24 VAC: 12 VA max/coil (Mercury contactors). 10VA max/coil (Magnetic contactors).

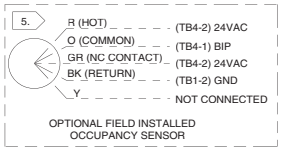
VV550—DDC LonMark Controller for ECM Fan-Powered Terminals

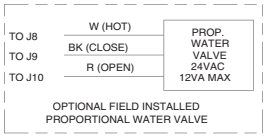
DD11—Space Temp Control Cooling Only
DD12—Space Temp Control w/ N.C. Hot Water Valve
DD13—Space Temp Control w/ Modulating Hot Water Valve
DD14—Space Temp Control w/ Stage Electric Heat
DD15—Space Temp Control w/ Pulse-width Modulation
DD17—Space Temp Control w/ N.O. Hot Water Valve

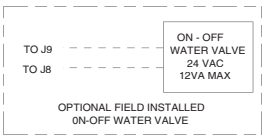








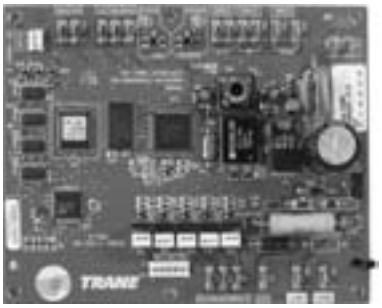




NOTES:

1. ——— Factory Wiring
   ..... Field Wiring
   — — — — Optional or Alternate Wiring
2. 1/4" Quick connect required for all field connections.
3. Zone sensor terminals 4 and 5 require twisted pair wiring for communcations jack equipped zone sensor option.
4. No additional wiring required for night setback override (ON/CANCEL).
5. The optional binary input connects between TB4–1 (BIP) and 24VAC (HOT) from transformer. Input can be reconfigured as an occupancy input via the communications interface.
6. Fan CFM can be easily adjusted from its min CFM to its max CFM via the ECM control board dial switches with a flat-head screwdriver. The switches set the percentage flow.
7. Contactors are 24 VAC: 12VA max/coil (Mercury contactors). 10VA max/coil (Magnetic contactors).
8. Transformer provided in all units.
9. Three-stage not available with pulse-width modulation.

LonMark Direct Digital Controller—Unit Control Module



The Trane LonMark direct digital controller Unit Control Module (DDC-UCM) is a microprocessor-based terminal unit with non-volatile memory which provides accurate airflow and room temperature control of Trane and non-Trane VAV air terminal units. LonMark provides a simple open protocol to allow integration of Trane VAV units and controls into other existing control systems. The UCM can operate in pressure-independent or pressure-dependent mode and uses a proportional plus integral control algorithm. The controller monitors zone temperature setpoints, zone temperature and its rate of change and valve airflow (via flow ring differential pressure). The controller also accepts an auxiliary duct temperature sensor input or a supply air temperature value from Tracer Summit. Staged electric heat, pulse width modulated electric heat, proportional hot water heat or on/off hot water heat control are provided when required. The control board operates using 24-VAC power. The Trane LonMark DDC-UCM is also a member of the Trane Integrated Comfort™ systems (ICS) family of products. When used with a Trane Tracer Summit™ building management controller or other Trane controllers, zone grouping and unit diagnostic information can be obtained. Also part of ICS is the factory-commissioning of parameters specified by the engineer (see "Factory-Installed vs. Factory-Commissioned" in the Features and Benefits section for more details).

Note: Trane LonMark DDC-UCM controllres can also take advancage of factory-commissioned quality on non-Trane systems through LonMark open protocol.

SPECIFICATIONS

Supply voltage:
24 VAC, 50/60 Hz

Maximum VA load:
No heat or fan:
8 VA (Board, Transducer, Zone Sensor, and Actuator)

Note: If using field-installed heat, 24 VAC transformer should be sized for additional load.

Output ratings:

Actuator Output:	24 VAC at 12 VA
1st Stage Reheat:	24 VAC at 12 VA
2nd Stage Reheat:	24 VAC at 12 VA
3rd Stage Reheat:	24 VAC at 12 VA

Binary input:
24 VAC, occupancy or generic.

Auxiliary input:
Can be configured for discharge or primary air temperature sensor.

Operating environment:
32 to 140°F, (0 to 60°C)
5% to 95% RH, Non-condensing

Storage environment:
-40 to 180°F (-40 to 82.2°C),
5% to 95%RH, Non-Condensing

Physical dimensions:

Width:	5.5" (139.7 mm)
Length:	4.5" (69.85 mm)
Height:	2.0" (44.45 mm)

Connections:
1/4" (6.35 mm) Stab Connections

Communications:
LonMark – Space Comfort Control (SCC) profile with FTT-10 transceiver.

22 awg. unshielded level 4 communication wire.

Fan control:

Series fan:	On unless unoccupied and min. flow has been released.
Parallel fan:	On when zone temperature is less than heating setpoint plus fan offset. Off when zone temperature is more than heating setpoint plus fan offset plus 0.5°F (0.28°C).

Heat staging:
Staged electric or hot water proportional or pulse-width modulation

For additional accessory information, refer to pages C 17 – 25.

Table 1 provides an input/output listing for Tracer VV550/551 VAV controllers. Table 2 provides the configuration properties for the controller. The content of the lists conforms to both the LonMark SCC functional profile 8500 and the LonMark node object.

Table 1. Input/output listing

Input description	Input	SNVT type
Space temperature	nviSpaceTemp	SNVT_temp_p
Setpoint	nviSetpoint	SNVT_temp_p
Occupancy, schedule	nviOccSchedule	SNVT_tod_event
Occupancy, manual command	nviOccManCmd	SNVT_occupancy
Occupancy sensor	nviOccSensor	SNVT_occupancy
Application mode	nviApplicMode	SNVT_hvac_mode
Heat/cool mode input	nviHeatCool	SNVT_hvac_mode
Fan speed command	nviFanSpeedCmd	SNVT_switch
Auxiliary heat enable	nviAuxHeatEnable	SNVT_switch
Valve override	nviValveOverride	SNVT_hvac_overid
Flow override	nviFlowOverride	SNVT_hvac_overid
Emergency override	nviEmergOverride	SNVT_hvac_emerg
Source temperature	nviSourceTemp	SNVT_temp_p
Space CO2	nviSpaceCO2	SNVT_ppm
Clear alarms/diagnostics	nviRequest*	SNVT_obj_request
Air flow setpoint input	nviAirFlowSetpt	SNVT_flow

* Part of the node object.

Output description	Output	SNVT type
Space temperature	nvoSpaceTemp	SNVT_temp_p
Unit status, mode	nvoUnitStatus	SNVT_hvac_status
Effective setpoint	nvoEffectSetpt	SNVT_temp_p
Effective occupancy	nvoEffectOccup	SNVT_occupancy
Heat cool mode	nvoHeatCool	SNVT_hvac_mode
Setpoint	nvoSetpoint	SNVT_temp_p
Discharge air temperature	nvoDischAirTemp	SNVT_temp_p
Space CO2	nvoSpaceCO2	SNVT_ppm
Effective air flow setpoint	nvoEffectFlowSP	SNVT_flow
Air flow	nvoAirFlow	SNVT_flow
File table address	nvoFileDirectory*	SNVT_address
Object status	nvoStatus*	SNVT_obj_status
Alarm message	nvoAlarmMessage	SNVT_str_asc

*Part of the node object.

Table 2. Configuration properties

Configuration property description	Configuration property	SNVT type	SCPT reference
Send heartbeat	nciSndHrtBt	SNVT_time_sec	SCPTmaxSendTime (49)
Occ temperature setpoints	nciSetpoints	SNVT_temp_setpt	SCPTsetPnts (60)
Minimum send time	nciMinOutTm	SNVT_time_sec	SCPTminSendTime (52)
Receive heartbeat	nciRecHrtBt	SNVT_time_sec	SCPTmaxRcvTime (48)
Location label	nciLocation	SNVT_str_asc	SCPTlocation (17)
Local bypass time	nciBypassTime	SNVT_time_min	SCPTbypassTime (34)
Manual override time	nciManualTime	SNVT_time_min	SCPTmanOverTime (35)
Space CO2 limit	nciSpaceCO2Lim	SNVT_ppm	SCPTlimitCO2 (42)
Nominal air flow	nciNomFlow	SNVT_flow	SCPTnomAirFlow (57)
Air flow measurement gain	nciFlowGain	SNVT_multiplier	SCPTsensConstVAV (67)
Minimum air flow	nciMinFlow	SNVT_flow	SCPTminFlow (54)
Maximum air flow	nciMaxFlow	SNVT_flow	SCPTmaxFlow (51)
Minimum air flow for heat	nciMinFlowHeat	SNVT_flow	SCPTminFlowHeat (55)
Maximum air flow for heat	nciMaxFlowHeat	SNVT_flow	SCPTmaxFlowHeat (37)
Minimum flow for standby	nciMinFlowStdby	SNVT_flow	SCPTminFlowStby (56)
Firmware major version	nciDevMajVer*	n/a	SCPTdevMajVer (165)
Firmware minor version	nciDevMinVer*	n/a	SCPTdevMinVer (166)
Flow offset for tracking applications	nciFlowOffset	SNVT_flow_f	SCPToffsetFlow (265)
Local heating minimum air flow	nciMinFlowUnitHt	SNVT_flow	SCPTminFlowUnitHeat (270)
Minimum flow for standby heat	nciMnFlowStbyHt	SVNT_flow	SCPTminFlowStbyHeat(263)

* Part of the node object.